Drought and climate adaptation program

DCAP3

CREATING ALTERNATE INCOME STREAMS TO INCREASE FARM PROFITABILITY AND BENEFIT THE ENVIRONMENT (UNISQ)

MILESTONE REPORT 7

Assess how targeted decision support could be used to 'de-risk' farmers' concerns about changing management practices to reduce climate risk/generate alternate income streams

Acknowledgements: *This project is funded by the Queensland Government's Drought and Climate Adaption Program (DCAP) that aims to improve drought preparedness and resilience for Queensland producers.*

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Contents

Background and summary of key findings

This report provides analysis underpinning a spatially explicit regional scale decision support system that provides information (in $ terms) about benefits/costs associated with alternate income streams associated with natural capital (namely carbon and biodiversity credit schemes). Additional to informing farmers the findings also help inform government/other agencies in terms of how much they need to invest, and where, to deliver the desired outcomes from natural capital projects, given the opportunity costs indicate that they are not financially attractive (competitive with crop production) options in most regions at this stage. An important limitation to keep in mind when reviewing the results outlined in this report is the scale of analysis. Using ABARES profit data (current at 5x5 km) means that the results are at a broad scale (i.e. not at the paddock scale). Future milestones (i.e. MS9b) as a part of this project will focus on downscaling approaches to provide finer scale farmer level decision making tools that assist them in assessing whether income diversification options are feasible and profitable on their land.

Specifically, this report outlines the results of cost-benefit analyses on 752 cropping areas in Queensland to assess their potential for generating environmental credits for farmers. Our scenario methods analysis was adapted to align with Queensland's Land Restoration Fund (LRF) schemes, incorporating LRF co-benefit components such as bio-condition, threatened species, essential habitat, and landscape ecology metrics. These findings are preliminary and subject to refinement, as we continue to collaborate within the UniSQ DCAP team and with DESTI.

We ran various scenarios–using Equation 1 (page 8) to calculate the potential environmental credit value (PEV)–to determine the income potential from environmental credit schemes. By incorporating spatial information from LRF and ABARES, we identified areas with the largest potential benefits for farmers.

Our analysis showed that most basins that currently support crop production are profitable for agriculture even in low-profit years, with few areas where agricultural profitability is low and environmental benefits are high. This indicates the potential for complex trade-offs between agriculture and environmental credit schemes.

We found that areas in southern and northern Queensland show most potential value for environmental credits, with benefits clustered in specific basins such as Balonne and Condamine. Mixed cropping and barley production systems have more patches with potential benefits. However, some areas, particularly in central Queensland, show negative value for environmental credits.

Our findings also suggest there is a substantial gap between the current value of environmental credit schemes and what is needed to benefit farmers. Many basins find these schemes not worthwhile even in low-profit years, although barley shows the most potential for environmental credit schemes.

Natural capital cost-benefit analysis – where are the environmental credit opportunities across Queensland cropping zones?

We ran cost-benefit analyses across 752 discrete patches of cropping area across Queensland that may have the potential to generate environmental credits for farmers; these patches represent areas where cropping land has fallen out of production over the recent past (2003-2019) – derived from Potapov et al., (2020). Further details of this cropping land loss data and how it relates to climate was provided in our Milestone reports 3B and 3C.

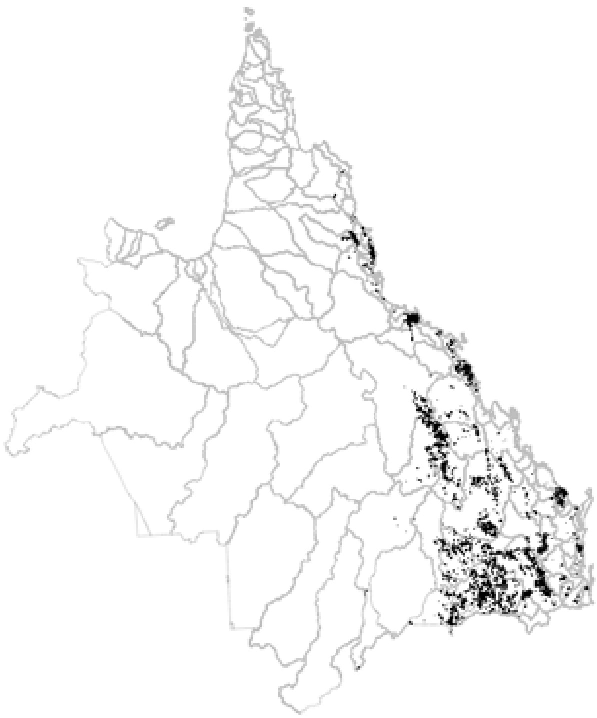

Figure 1. The 752 discrete patches investigated in the study. Each patch is an area where cropping land has been recently lost. Crop loss data is taken from Potapov et al. (2020) who mapped net change in crop land over the recent past (2003-2019). Here we include all areas with >5% of net crop loss across Queensland. Clusters or connected groups of crop loss are assessed as one discrete patch.

Assessing the cost-benefit of environmental credit schemes across Queensland's cropping areas

Methods

We adapted our scenario methods analysis from previous milestones and updated it using approaches that align with the Queensland government's Land Restoration Fund (LRF) scheme.

In brief, we added LRF co-benefit components that incorporate information on bio-condition, threatened species, essential habitat and landscape ecology metrics associated with patch area size and connectivity. It should be noted that the UniSQ DCAP team is still working with collaborators in DESTI on the methods (and results) presented below and so the findings below should be treated as preliminary as they may alter as methods are refined. For further information on the LRF please see: https://www.qld.gov.au/environment/climate/climate-change/land-restoration-fund

We ran a range of scenarios assuming all possible combinations of a range of values important for determining the income generation potential of switching from crop production to environmental credit schemes in Queensland's climatically marginal cropping areas. To calculate the potential value of environmental (PEV) credits across climatically marginal areas we used Equation 1 below,

$$PEV = CSP*CPr + LRF\ co\text{-}benefit - AgPr - Cst*CSP - CSP*RkB - CSP*Bf \quad (Eqn.\ 1)$$

where PEV is the estimated potential environmental credit value, CSP is carbon sequestration potential, CPr is the price for carbon, RkB is the risk reversal buffer (this applies to all carbon abatement projects to insure participants against loss – see here for further information), Bf is brokerage fees, BV is the potential biodiversity credit value adjusted for biodiversity importance, Cst is the cost of establishing an environmental planting for carbon and biodiversity credits (which takes into account possible density of plantings/tonnes of sequestration) and AgPr are agricultural profits based on mapping from Hughes et al. (2022), which modelled agricultural profits across the country using ABARES extensive dataset across Australia's agricultural areas. Further information on the scenario analysis underpinning the cost-benefit analysis is provided in our Milestone 3 report.

By incorporating spatial information on environmental values (using LRF information) and spatial information on agricultural profits (from ABARES), we were able to run environment credit scenarios for 752 discrete patches across Queensland cropping areas. This mapping then allowed the identification of areas where environmental credit opportunities may offer the largest potential relative benefits to Queensland farmers.

Information on the parameters used in scenario analysis are plotted in Figure 2. Even in low profit/poor years most basins are largely profitable for agriculture. There are only a few examples where agricultural profitability is low and environmental benefits are high (Fig 2c). This suggests that in most cases there will be complex trade-offs between agriculture and environmental credit schemes that will need to be navigated.

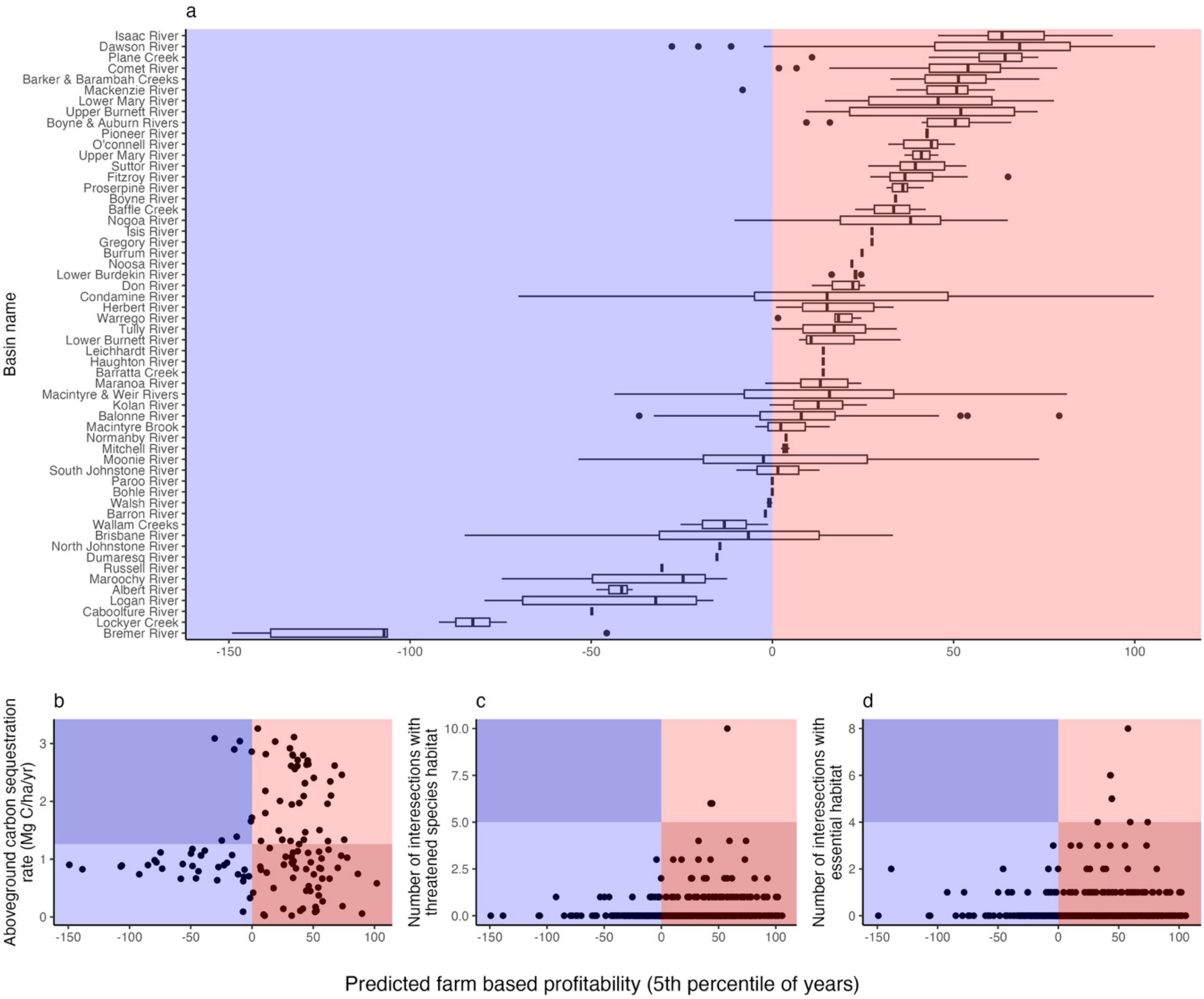

Figure 2. **Farm profit (low profit, 5th percentile) across the patches in each of the basins assessed, as well as the relationship between farm profit and environmental benefits**. Plot a. shows boxplots of the distribution (center horizontal line is the median; lower and upper sections are 25th and 75th percentiles, respectively; whiskers show the full range of the data, except for outliers which are shown as points) of farm-based profit (5th percentile) across each basin. Plots b-d are scatterplots showing the relationship between farm profit (5th percentile) and above ground carbon sequestration (plot b), number of threatened species (plot c) and essential habitat (plot d). Shading in plots b-d corresponds to different outcome scenarios. Dark blue indicates a ‘win-win’ where environmental benefits are high and agricultural profitability is low; light blue indicates where environmental benefits are low and agricultural profits are high (‘lose-win’); dark red indicates a ‘lose-lose’ where environmental benefits are high and agricultural profits are high; and light red indicates when environmental benefits are high and agricultural profits are high (‘win-lose’).

Results – Where does cost-benefit analysis suggest environmental credit options good value?

Cost-benefit scenario mapping suggests there are areas in southern Queensland and parts of northern Queensland where environmental credit options may show potential value for farmers (Figure 3). Most areas of potential environmental credit value appear to be clustered in five or so basins; these include basins in the south (e.g. Balonne and Condamine) and an isolated area in the north. This suggests that the benefits of environmental credit schemes will not be uniformly spread across the state's cropping areas. Across the crop types assessed, mixed cropping and barley production systems appear to have a disproportionately greater number of patches where environmental credit schemes are potentially beneficial (Fig 3c). In southern Queensland, the greatest number of potentially beneficial areas were identified in the Balonne, Condamine and Moonie catchments.

Importantly, there were also large areas where environmental credit opportunities showed negative value (even in low profit years). This was the case in parts of central Queensland. Note though that this mapping is based on low profit years and these results will change depending on climate, market and other conditions. It is also important to recognise the large variation in these results depending on the particular patch analysed and the scenario analysis parameters, with several catchments showing both net negative and positive results (Figure 3).

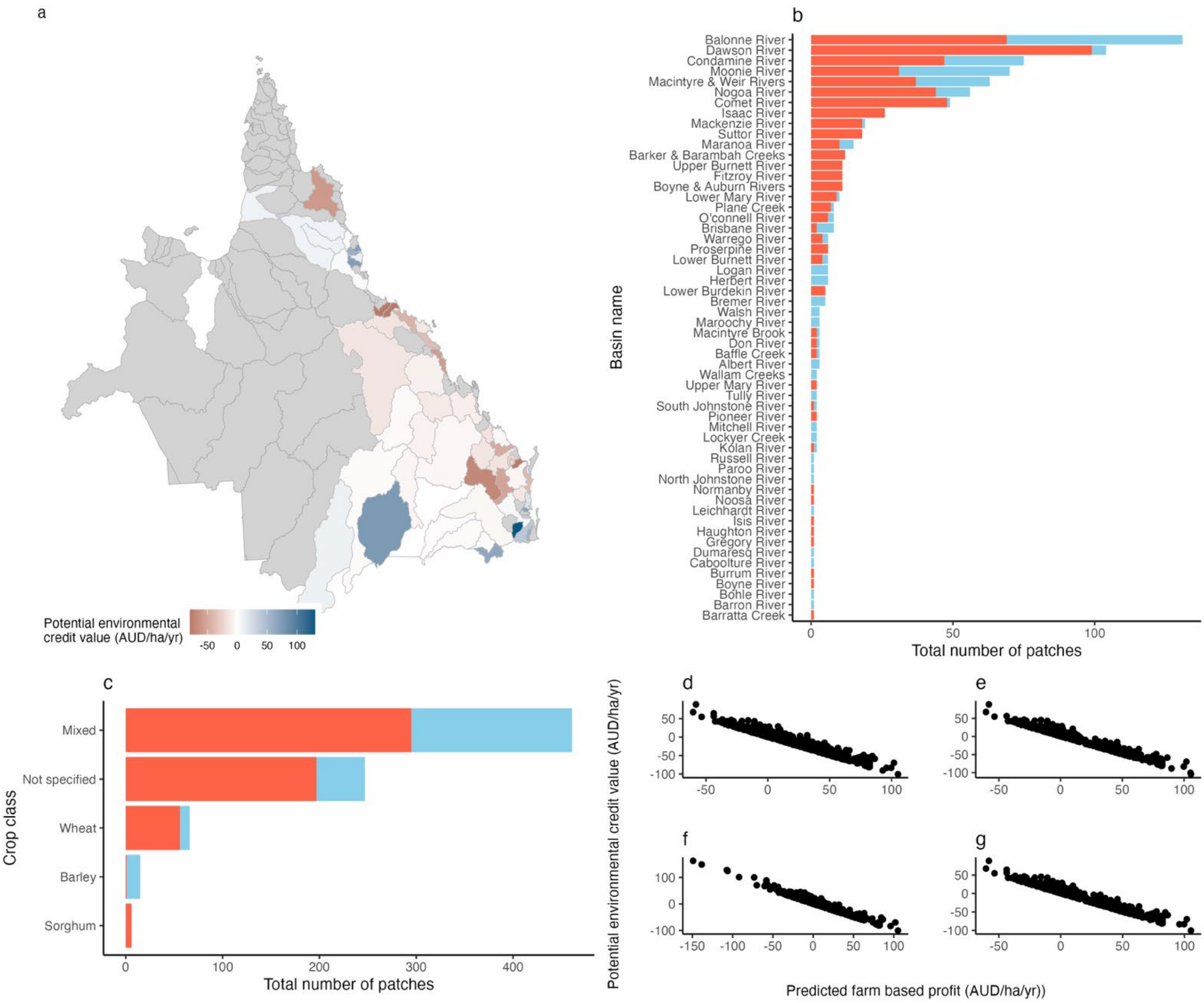

Figure 3. Potential environmental credit value under a low profit (5th percentile) scenario across each basin and crop class and the relationship between potential environmental credit value and farm profit. In plots a-c blue corresponds to a patch/basin with positive potential environmental credit value (i.e. >0$ AUD ha/yr) and red to negative value (i.e. <0$ AUD ha/yr). The scatter plots show relationship between potential environmental credit value and farm profit (5th percentile) for wheat (plot d), sorghum (e), barley (f) and mixed cropping (g).

Results – In many areas there is a payment gap

On average, across most basins there is a substantial gap between the current value that environmental credit schemes offer and what needs to be added in order to make them beneficial for farmers. Based on our analysis, across most basins (~10/26), environmental credit schemes are not worthwhile for farmers, even in low profit (5th percentile) years (Fig 4). Across the crop classes investigated, barley shows the most potential for benefit from the transition to environmental credit schemes (Fig 5).

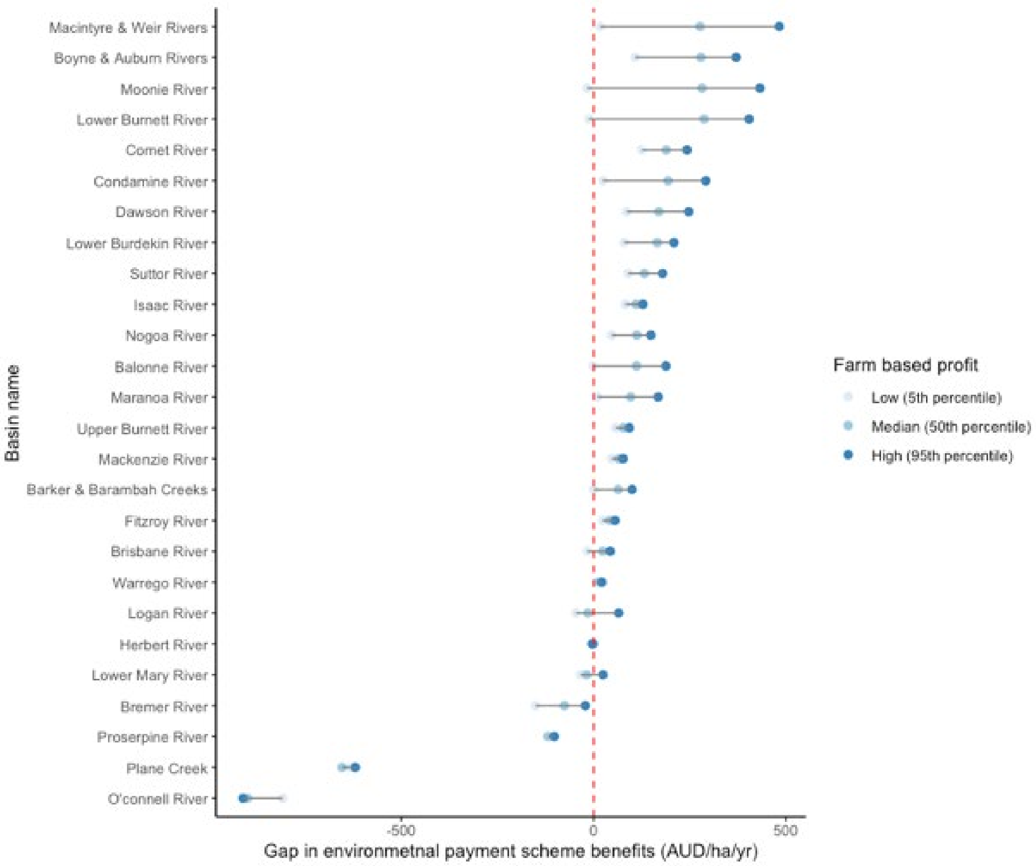

Figure 4. The gap between potential environmental payment scheme benefits (AUD/ha/yr). The gap indicates the dollar value (AUD/ha/yr) increase needed to be made for environmental credit schemes to at least ‘break-even’ for farmers. Negative values indicate that no additional value is needed, while positive values indicate larger benefits are needed. The dashed red line at ‘0’ is the ’break-even’ point. The gap is the difference between farm-based profit and the value (AUD/ha/yr) at which it is cost-neutral for the farmer to switch from cropping to an environmental credit scheme. Gap calculations are across all patches and assessed scenarios within each basin. Light blue, blue and dark blue points correspond to low farm profit (5th percentile), median farm profit (50th percentile) and high farm profit (95th profit) scenarios, respectively.

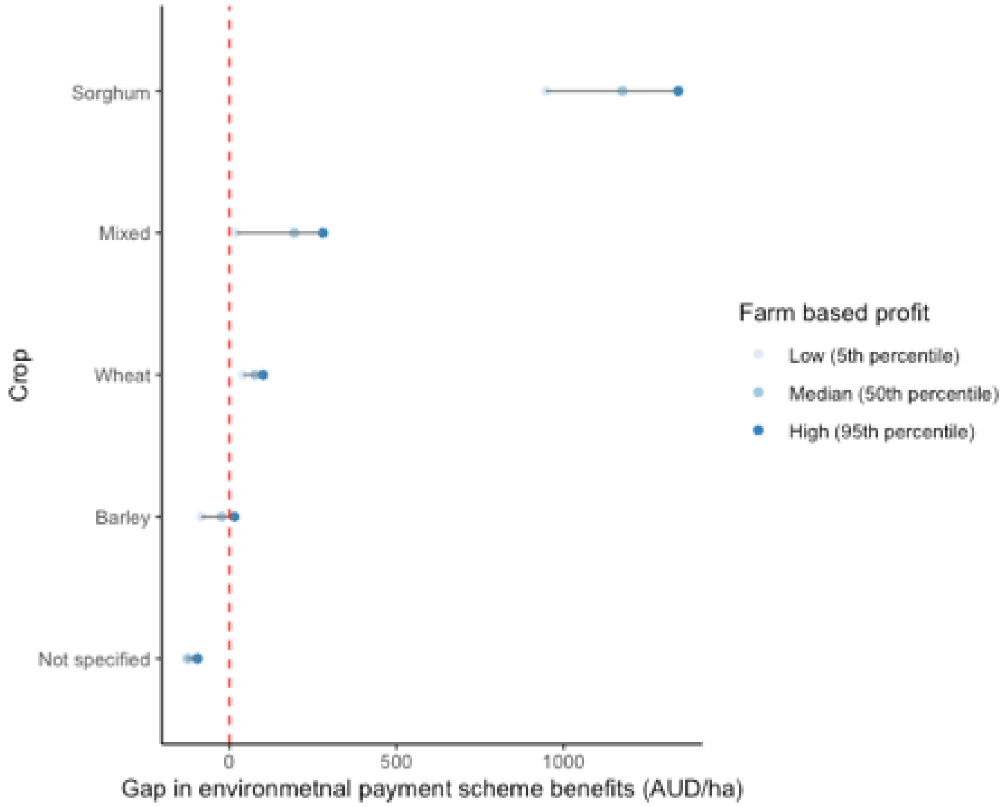

Figure 5. The gap between potential environmental payment scheme benefits (AUD/ha/yr) across different crop classes. The gap indicates the dollar value (AUD/ha/yr) increase needed for environmental credit schemes to at least 'break-even' for farmers. Negative values indicate that no additional value is needed, while positive values indicate larger benefits are needed. The dashed red line at '0' is the 'break-even' point. The gap is the difference between farm-based profit and the value (AUD/ha/yr) at which it is cost-neutral for the farmer to switch from cropping to an environmental credit scheme. Gap calculations are across all patches and assessed scenarios within each crop class. Light blue, blue and dark blue points correspond to low farm profit (5th percentile), median farm profit (50th percentile) and high farm profit (95th profit) scenarios, respectively.

Next steps

- Using the mapping results presented in this milestone report, the project team (incl. QFF) will identify additional case study areas (MS8) and develop further farm-level case studies (MS9a).
- Working with QFF and using farmer feedback, the team will develop downscaling approaches to provide farmer level decision making tools that assist them in assessing whether income diversification options are feasible and profitable on their land (MS9b)

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